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Association between frailty and changes in lifestyle and physical or psychological conditions among older adults affected by the coronavirus disease 2019 countermeasures in Japan

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Aim: This study aimed to clarify the association between frailty and changes in lifestyle and physical or psychological conditions among community-dwelling older adults affected by the coronavirus disease 2019 countermeasures in Japan.

Methods: This cross-sectional study was carried out between 8 May and 12 June 2020 in Japan. Self-reported questionnaires were distributed among 1353 older adults. To assess frailty, we used the frailty screening index. To assess changes in lifestyle and physical or psychological conditions, we developed the Questionnaire for Change of Life (QCL), which comprised five items related to frailty. Cronbach's α was calculated as a measure of internal consistency of QCL. We compared the score for each item in the QCL between the frailty and non-frailty groups. Multiple logistic regression analysis was used to show the factors that affect frailty status.

Results: In total, 856 older adults (63.3%) were analyzed. A total of 83 participants (9.7%) had frailty, and 755 participants (90.3%) had non-frailty. Cronbach's α for QCL was 0.552. We observed a significant decrease in daily movement, leg muscle strength and meal size among older adults with frailty compared with non-frailty ($P < 0.001$). Subjective leg muscle strength (odds ratio 3.257, 95% confidence interval 2.236–4.746) was negatively correlated with frailty.

Conclusions: We suggest that each individual QCL item should be used in analyses involving the QCL. This report showed that subjective lifestyle changes affected by the coronavirus disease 2019 countermeasures were associated with frailty status. In particular, as older adults were aware of a decrease in their leg muscle strength, they were significantly more frail. **Geriatr Gerontol Int 2021; 21: 39–42**.

Keywords: countermeasure for the viral infection, COVID-19, frailty, older adult.

Introduction

The coronavirus disease 2019 (COVID-19) has spread worldwide, and has affected the health and lifestyle of many people. The Japanese government issued a state of emergency on 16 April 2020 and lifted the declaration in all prefectures on 25 May 2020.[1] Many older adults were less likely to undergo lifestyle changes according to this request for restraint. In Japan, which has a hyper-aged society, there is a need to facilitate healthy aging and maintain functional capacity;[2] so frailty is a geriatric problem. Lifestyle changes implemented as COVID-19 countermeasures, such as decreased activity, increased anxiety and decreased communication, resulted in increased frailty. We called this frailty "corona-frailty".[3] It is important to determine what changes in lifestyle and physical or psychological conditions affect frailty, so that policy-makers and local government commissioners can consider strategies to prevent frailty during a pandemic. However, there are few reports regarding frailty and lifestyle changes among uninfected older adults affected by COVID-19 countermeasures.

We hypothesized that changes in lifestyle and physical or psychological conditions affect frailty status. The present study aimed to clarify the association between frailty and changes in lifestyle and physical or psychological conditions among community-dwelling older adults affected by COVID-19 countermeasures.

Methods

Study design and participants

The present cross-sectional study was carried out between 8 May and 12 June 2020 in Takasaki City, Gunma Prefecture, Japan. Gunma Prefecture requested older adults to refrain from going out until 12 June 2020. The participants were 1353 community-dwelling older adults aged ≥65 years who live in local housing and who were helped on a regular basis by local volunteers. The participants were not excluded due to the presence of specific types of comorbidities and/or disorders, to enable a broad investigation of the actual condition of older adults. We distributed the self-

reported questionnaires to the participants by local volunteers. The questionnaires contained written informed consent and were returned by post. The present study was carried out in accordance with the tenets of the Declaration of Helsinki. This study was registered with the University Hospital Medical Information Network (UMIN000040335).

Measurements

We created a questionnaire that older adults can answer without support, to avoid contact and to ensure social distancing. Frailty was assessed using the Frailty Screening Index (FSI), which is comprised of five items answerable with yes/no responses.[4]

The FSI was used to assess physical/psychological frailty, and had predictive validity for disability[4] and concurrent validity for social frailty[5] among Japanese older adults. The FSI is a questionnaire that comprises five items; "Have you lost 2 kg or more in the past 6 months?", "Do you think you walk slower than before?", "Do you go for a walk for your health at least once a week?", "Can you recall what happened 5 minutes ago?" and "In the past 2 weeks, have you felt tired without a reason?". These items are answered with simple yes/no responses, and scoring ranged from 0 to 5. It does not require an actual measurement of grip strength or walking speed. The frailty status was based on the participant's score, where a score of ≥3 was defined as frailty, 1–2 as prefrailty and 0 as robust.[4]

The FSI questioned the participants about their weight loss in the past 6 months and decreased walking speed. However, recent changes affected by the COVID-19 countermeasures were not clarified. The recent changes are important to assess, and allow us to examine the impact of current and future risks to frailty; therefore, the Questionnaire for Change of Life (QCL) was prepared to evaluate the impact of COVID-19 countermeasures on changes in lifestyle and physical or psychological conditions. The QCL was created with a 5-point Likert scale, and contained five items about lifestyle and physical or psychological conditions related to frailty: amount of daily movement, "How about the amount of movement in your life?"; leg muscle strength, "How strong are your legs?"; meal size, "How's your food intake?"; worry or anxiety, "How's your worry and

Table 1 Characteristics of participants in the frailty and non-frailty groups

	Overall		Frailty		Non-frailty		*P*-value	Effect size[†]
	n = 856		*n* = 83		*n* = 773			
Age (mean ± SD)	78.4 ± 6.2		80.1± 6.0*		78.3 ± 6.2		0.009	0.291
Female, *n* (%)	649 (75.8%)		62 (74.7%)		587 (75.9%)		0.802	0.009
QCL, *n* (%)	*n* (%)							
(1) Amount of daily movement, median (IQR)	3.0	(2.0–3.0)	2.0**	(1.0–3.0)	3.0	(2.0–3.0)	<0.001	0.178
1. Decreased	137	(16.0)	29	(34.9)	108	(14.0)		
2. Slightly decreased	231	(27.0)	22	(26.5)	209	(27.0)		
3. Unchanged	444	(51.9)	29	(34.9)	415	(53.7)		
4. Slightly increased	31	(3.6)	3	(3.6)	28	(3.6)		
5. Increased	13	(1.5)	0	(0.0)	13	(1.7)		
(2) Leg muscle strength, median (IQR)	3.0	(2.0–3.0)	2.0**	(1.0-2.0)	3.0	(2.0–3.0)	<0.001	0.333
1. Weaker	90	(10.5)	32	(38.6)	58	(7.5)		
2. Slightly weaker	304	(35.5)	37	(44.6)	267	(34.5)		
3. Unchanged	449	(52.5)	13	(15.7)	436	(56.4)		
4. Slightly stronger	10	(1.2)	1	(1.2)	9	(1.2)		
5. Stronger	3	(0.4)	0	(0.0)	3	(0.4)		
(3) Meal size, median (IQR)	3.0	(3.0–3.0)	3.0**	(2.0–3.0)	3.0	(3.0–3.0)	<0.001	0.24
1. Decreased	23	(2.7)	11	(13.3)	12	(1.6)		
2. Slightly decreased	106	(12.4)	18	(21.7)	88	(11.4)		
3. Unchanged	677	(79.1)	49	(59.0)	628	(81.2)		
4. Slightly increased	43	(5.0)	4	(4.8)	39	(5.0)		
5. Increased	7	(0.8)	1	(1.2)	6	(0.8)		
(4) Worry or anxiety, median (IQR)	3.0	(2.0–3.0)	2.0	(2.0–3.0)	3.0	(2.0–3.0)	0.353	0.146
1. Increased	67	(7.8)	11	(13.3)	56	(7.2)		
2. Slightly increased	302	(35.3)	31	(37.3)	271	(35.1)		
3. Unchanged	453	(52.9)	32	(38.6)	421	(54.5)		
4. Slightly decreased	31	(3.6)	8	(9.6)	23	(3.0)		
5. Decreased	3	(0.4)	1	(1.2)	2	(0.3)		
(5) Opportunities to talk to people, median (IQR)	2.0	(1.0–3.0)	2.0	(1.0–3.0)	2.0	(1.0–3.0)	0.435	0.054
1. Decreased	257	(30.0)	29	(34.9)	228	(29.5)		
2. Slightly decreased	258	(30.1)	22	(26.5)	236	(30.5)		
3. Unchanged	328	(38.3)	32	(38.6)	296	(38.3)		
4. Slightly increased	8	(0.9)	0	(0.0)	8	(1.0)		
5. Increased	5	(0.6)	0	(0.0)	5	(0.6)		

[†]Effect size was estimated using Cohen's d for age and Cramer's V for sex and items of the Questionnaire for Change of Life (QCL).

*$P < 0.05$.

**$P < 0.001$.

IQR, interquartile range.

Table 2 Results of multivariate logistic regression for determinating frailty and non-frailty

Independent variables		β	*P*-value	Odds ratio	95% CI	
					Lower	Upper
Age		−0.009	0.672	0.991	0.951	1.033
Sex		−0.037	0.898	0.963	0.543	1.708
QCL						
(1)	Amount of daily movement	0.272	0.119	1.313	0.932	1.849
(2)	Leg muscle strength	1.181	0.000	3.257	2.236	4.746
(3)	Meal size	0.378	0.052	1.459	0.997	2.136
(4)	Worry or anxiety	−0.057	0.729	0.944	0.682	1.307
(5)	Opportunities to talk to people	−0.103	0.537	0.902	0.650	1.251

CI, confidence interval; QCL, Questionnaire for Change of Life.

anxiety?"; and opportunities to talk to people, "How about an opportunity to communicate with people?". Frailty has three dimensions. Physical frailty is related to the amount of daily movement,[6] leg muscle strength[7] and meal size;[8] cognitive frailty is related to the amount of daily movement,[9] including worry or anxiety;[10] and social frailty is related to opportunities to talk to people.[11] All authors and community supporters involved with the target participants consulted each other to prepare these five questions that were easy to answer for older adults without anyone's support at home, which is important to maintain social distancing as a preventive measure against infection. The participants were asked about the subjective changes in the previous month to evaluate changes in their lifestyle due to the measures implemented to prevent the spread of COVID-19. Each item was scored in the following scale: decreased or weaker = 1, slightly decreased or weaker = 2, unchanged = 3, slightly increased or stronger = 4 and increased or stronger = 5 on all items except for those about worry or anxiety, which were scored as: increased = 1, slightly increased = 2, unchanged = 3, slightly decreased = 4 and decreased = 5. The application of QCL was further confirmed by questioning seven older adults, who did not participate formally, but agreed to answer the QCL before this study was carried out. Furthermore, they could answer all the questions.

Statistical analysis

Cronbach's α was calculated as a measure of internal consistency of QCL. The relationships among all item scores of the QCL were tested using Spearman's rank correlation coefficient. We defined FSI scores of ≥3 as frailty and 0–2 as non-frailty.[4] We compared ages using the *t*-test, sex using the χ^2-test, and each item score of the QCL between frailty and non-frailty using the Mann–Whitney *U*-test. To assess the degree of difference, effect size was estimated using or Cramer's V. Multiple logistic regression analysis based on forced entry methods was used. Frailty status was the dependent variable, and age, sex and each item score of the QCL were the independent variables. All statistical analyses were carried out using IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY), with *P*-values <0.05 showing statistical significance.

Results

In total, 886 older adults returned the questionnaires with written consent, and the response rate was 65.5%. We analyzed 856 older adults who answered all questions (63.3%). The percentage of participants able to respond to all the questions was 96.6%.

Cronbach's α for QCL was 0.552. Spearman's rank correlation coefficient among all item scores of the QCL ranged from 0.051 to 0.438.

A total of 83 participants (9.7%) had frailty and 773 participants (90.3%) did not. There was a significant difference in age ($P < 0.05$) and three items in the QCL – amount of daily movement, leg muscle strength and meal size – between frailty and non-frailty groups ($P < 0.001$; Table 1).

Table 2 shows the results of multiple logistic regression. Leg muscle strength (odds ratio 3.257, 95% confidence interval 2.236–4.746) was negatively correlated with frailty – a decrease in subjective leg muscle strength in a month was associated with frailty.

Discussion

The internal consistency of QCL was poor, and correlations among each item of the QCL were low, because we integrated QCL aspects from the three dimensions of frailty and included just five items. We suggest that each individual QCL item, and not the total score, should be used in analyses involving the QCL. Zhang and Ma reported on the impact of COVID-19 on mental health and quality of life by using the internet.[12] The internet usage rate of older adults in Japan was 45.8% in households with only older adults.[13] Internet-based surveys might fail to assess older people. The questionnaire we developed was answered by >95% of the older adults who returned their responses; therefore, it was useful for self-assessment during a pandemic to avoid contact with others.

Both the FSI and the QCL were prepared to assess the frailty-related conditions and changes. The difference was that the FSI assessed the current conditions and long-term changes, whereas the QCL assessed the changes over the past month that might have been more affected by the COVID-19 countermeasures. The QCL assessment showed that the COVID-19 countermeasures might lead to a reduction in the extent of daily movement, leg muscle strength and meal size among older adults with frailty compared with non-frail older adults. In particular, subjective decreased leg muscle strength had a significant negative relationship with frailty. Yamada *et al.* reported that the time spent doing physical activity significantly decreased as a result of the COVID-19 pandemic affecting older adults in Japan.[14] For healthy older adults and older adults with frailty, muscular weakness is decreased by physical activity, ranging from low intensity walking to more vigorous sports and resistance exercise.[15] However, it is difficult to increase physical activity by conventional approaches in pandemics. New models of movement, such as telehealth

exercise programs[16] and mobile technology, to help maintain mobility,[17] are being developed. The physical activity levels of community-dwelling older adults should be increased by using new methods that also consider infection control. Dietary intake, along with physical activity, also plays a significant role in the onset and progression of frailty.[8] The current study showed the importance of physical activity and diet. Policy-makers and local government commissioners should prioritize these aspects to help improve the quality of life of community-dwelling older adults.

The interaction between age-related chronic diseases, the aging process, oxidative stress and inflammation might lead to frailty.[18] Age has been considered to be related to frailty, but the results of multiple logistic regression analysis in the present study did not show a relationship between age and frailty. The participants with frailty were significantly older, but the effect size was small (d = 0.291). Furthermore, the mean age and standard deviation of the participants were 78.4 years and 6.2 years, respectively, and the participants were relatively older and around the mean age. Therefore, we suggested that the effect of age was minimal between frail and non-frail individuals, and frailty was affected more by changes in lifestyle and physical or psychological conditions among older adults aged approximately 80 years.

The present study had several limitations. First, it is necessary to identify the changes over time in frail and non-frail individuals to understand how lifestyle changes affect frailty status; therefore, we plan to carry out a cohort study in the future.[19] Second, we had to use an easy questionnaire and did not collect data regarding underlying diseases and other factors related to frailty. The present study was carried out under limited conditions while taking infection control measures. Third, we could not measure physical activity and muscle strength quantitatively using any instruments or monitor actual meal size.

In conclusion, the current study made a novel contribution that the subjective amount of daily movement, leg muscle strength and meal size decreased among older adults with frailty during the COVID-19 pandemic in Japan. In particular, subjective decreased leg muscle strength had a significant negative relationship with frailty. As community-dwelling older adults were aware of the decrease in leg muscle strength in a month, they were significantly more frail.

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Disclosure statement

The authors declare no conflict of interest.

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